Jersey Scheme for Certification of Design (Building Structures)

SER JERSEY TECHNICAL BULLETIN NUMBER 2

GUIDELINES FOR CHECKING THE STRUCTURAL DESIGN OF BUILDINGS

Introduction

This Technical Bulletin has been prepared with the following purposes in mind:

1. To describe the range of minor projects that an Approved Certifier may certify when he/she has also carried out both the design and the check.
2. To provide guidance on how checking of work that is not covered by 1 above should be undertaken.

In the situation described in 1 above the SER design certificate is signed by an Approved Certifier who is also the designer. It is recognised that there will be no independent check of the design and this carries a risk that an error in the design will go undetected. It is therefore restricted to situations where this risk is regarded as being low due to the low occupancy and conventional design of the structures involved.

It is the responsibility of the Certifier to determine the appropriate level of checking that should be applied to a particular design. The guidance contained in this document is intended to aid that decision however other considerations may apply such as more extensive checking standards arising through contractual requirements of a client or by a firms in-house QA procedures.

This bulletin applies to Building Permit applications for new buildings, for alterations and/or extensions to existing buildings, and buildings undergoing a material change of use.

Jersey Scheme for Certification of Design (Building Structures)

Background

A high proportion of building failures can be attributed to errors in the design. Research carried out in Europe and the USA have conservatively estimated that between 25% and 35% of construction failures can be attributed to design errors which can arise for a number of reasons that include:

- Lack of experience by the designer
- Human error
- Communication failure between members of the design team
- Contractual inhibitions
- Inappropriate application/use of the design codes
- Failure to translate design assumptions to the construction of the works

The Standing Committee on Structural Safety (SCOSS) in their 13th report stated *"There is a general awareness of the possibility that individuals or organisations may introduce errors in design and construction through lack of competence or simply through a mistake or dishonesty."* and in their 15th report SCOSS drew attention to the fact that design responsibilities are often allocated amongst a number of designers and suppliers and to the design risks that can arise at the interfaces of these designers when contractual arrangements make designers unable or unwilling to take an overall view of the impact of their design input on the safety of the project.

While the structural design codes such as BS8110 and BS 5950 make clear the need for a single designer to take responsibility for the overall design these codes are not mandatory under the building bye-laws and the identification of the designer with this role may not be evident.

The Building Bye-laws (Jersey) 2007 has addressed these concerns by the introduction of a provision for design certificates to be provided by Approved Certifiers of Design: Building Structure (Certifiers) who have specific responsibilities for the integrity of the design process. This will involve overseeing the interface between designers to ensure that design assumptions on matters such as loading are consistent across the design team and ensuring that structural calculations have been adequately checked.

The importance of checking that design information has been properly interpreted in the preparation of the building permit plans and specifications cannot be overstated. A check of these documents is integral to the checking process.

Checking of structural designs is at the heart of the certification process. Checking may be undertaken at a variety of levels, depending on factors such as the complexity of the design, and by more than one individual. It is the responsibility of the Certifier however to oversee this process and be satisfied
that the manner in which checking has been undertaken provides an adequate level of design reliability with regard to the risks involved. It is the duty of the certifier to assess

the competence of the checker and determine the appropriate level of check that should be undertaken in a particular instance.

This Technical Bulletin provides guidance for members of the SER Ltd scheme on how they should approach the management of risk with regard to checking of structural designs. Following the guidance given in this Bulletin will be regarded as evidence of fulfilling the requirements of the scheme for the relevant audit criteria.

Reliability Management

Guidance on achieving acceptable levels of design reliability is provided within BS EN 1990:2002 Eurocode- Basis of structural design. The SER approach to checking has been guided by the recommendations of this code.

Design Check Level (DCL)	**Minimum requirement for checking drawings, calculations and specification.**
DCL1 Self Check	A Certifier, who is also the designer, can check his/her own calculations
DCL 2 Simple Check	The design will be subject to a review by individuals who were not involved in the preparation of the design calculations. A Certifier who is not also the designer may undertake this check.
DCL 3 Intermediate Check	The design will be subject to a more detailed check of the calculations than would be the case for a Simple Check and may still be undertaken by individuals who are members of the design team but who were not involved in the preparation of the design calculations. A Certifier who is not also the designer may undertake this check.
DCL 4 Extended Check	Third party checking: a detailed check with reference to the drawings but not the original calculations to be

	undertaken by a person or team who have not been involved with any aspect of the original design.

The reliability of the structural design will be enhanced by checking however all designs do not need to undergo the same level of check for an acceptable level of design reliability to be attained. The Design Check Level (DCL) requirements, described in the above table are based around the Design Supervision Level concept proposed in EN 1990.

It is the responsibility of the Certifier to identify the appropriate level of check to be undertaken for a particular project, or part of a project, and to establish that this check has been undertaken by persons with the appropriate knowledge and experience. In deciding the appropriate level of reliability check for a particular structure the Certifier should take account of the following factors:

- The complexity of the design
- The experience of the design team
- The possible consequences of failure in terms of risk to life, injury, economic loss or environmental impact.
- Public aversion to failure
- The expense necessary to undertake the check.

Different levels of reliability may be applied to different aspects of the design and to checks for ultimate limit state and for serviceability limit states.

Risk Classification

A key factor in deciding an appropriate Design Check Level is the consequence of failure of the structure. Three risk classes, based on the consequence classification proposed within EN 1990, have been adopted by the SER checking procedure as follows:

Risk Class	Description
RC1	**Low** consequence for loss of human life and economic, social or environmental consequences **small or negligible**
RC2	**Medium** consequence for loss of human life, economic, social or environmental consequences **considerable**
RC3	**High** consequence for loss of human life or economic, social or environmental consequences **very great.**

Research, categorising the risks presented by different types of building by reference to their occupancy, was carried out on behalf of UK Government Departments. The aim of the research was to inform decisions on changes to building regulations dealing with disproportionate collapse within England & Wales. The methodology employed to categorise buildings for accidental damage is however applicable for the purposes of this procedure.

Four risk classifications have been derived from:

- A risk factor which comprises a load parameter and a structural parameter

And

- A Consequence factor which takes account of the numbers of people at risk, the location and a societal criteria.

A full explanation of the derivation of the risk categories can be had by reference to the research documentation which can be obtained from the Department of Communities and Local Government web site www.dclg.gov.uk. For the great majority of buildings however the appropriate risk category can be obtained by reference to the following tables.

Jersey Scheme for Certification of Design (Building Structures)

Designs where no independent check is necessary (Certifier may also be the designer and carry out the design check)

Risk Classification	**Building Type and Occupancy**
RC1	Dwelling houses (see note 2 below) including alterations and extensions to houses. Retaining walls up to a maximum height of 2 metres and buildings of a type described in Schedule 1 to the Building Bye-laws (Jersey) 2007. (see note 3) Minor alterations to industrial premises, storage buildings or offices which in the opinion of the Certifier fall within the description of the RC1 risk classification.

Note 1: For buildings intended for more than one type of use the Class should be that pertaining to the most onerous type.

Note 2: A “dwelling house” means a separate dwelling on one or more storeys, which is either detached or where it forms part of another building it is divided only vertically.

Note 3: Schedule 1 to the building bye-laws lists a number of building types which are exempt from the requirements of the bye-laws subject to certain criteria being met. The RC1 classification therefore applies to certificates issued in support of building permit applications for buildings of the type listed which do not meet the specified exemption criteria.

Jersey Scheme for Certification of Design (Building Structures)

Designs that must be subject to an independent check:

Risk Classification	Building Type and Occupancy
RC2A	Hotels not exceeding 4 storeys Flats, apartments and other residential buildings not exceeding 4 storeys Offices not exceeding 4 storeys Industrial buildings not exceeding 3 storeys Shops and enclosed shopping centres not exceeding 3 storeys of less than 2000 sq.m floor area in each storey Single storey educational buildings Assembly buildings (other than educational buildings), entertainment buildings and other buildings accessible to the general public all not more than 2 storeys and with each storey area of not more than 2000 sq.m.
RC2B	Hotels, flats, apartments and other residential buildings greater than 4 storeys but not exceeding 15 storeys Educational buildings greater than 1 storey but not exceeding 15 storeys Shops and enclosed shopping centres greater than 3 storeys but not exceeding 15 storeys Hospitals not exceeding 3 storeys Offices greater than 4 storeys but not exceeding 15 storeys Assembly buildings (other than educational buildings), entertainment buildings and other buildings accessible to the general public and with each storey area of more than 2000 sq.m but not more than 5000 sq.m. Open sided carparks and storage buildings more than 6 storeys Grandstands accommodating up to 5000 spectators
RC3	High occupancy multi-storey buildings > 15 storeys, Buildings having unconventional construction or innovative design and building constructions prone to dynamic instability. All buildings defined above as RC 2A and RC2B that exceed the limits on area and/or number of storeys Grandstands and sports arenas accommodating more than 5000 spectators.

Note 1: For buildings intended for more than one type of use the Class should be that pertaining to the most onerous type.

Jersey Scheme for Certification of Design (Building Structures)

Design Check Level (DCL)	**Relevant Risk Classification**	**Scope of Structural Check**
DCL 2 Simple Check	RC2A	Check will take the form of a design review comprising: · Principles and primary design features · Checking of sample calculations · Review of SI data and bearing capacity assumptions and foundation design · Detailed scrutiny of stability and loading assumptions. · Checking of reinforcement drawings, including any cover necessary for structural fire protection. · In the case of alterations a review of the condition assessment of the existing building · In the case of buildings undergoing a material change of use a review of the design to ensure any works necessary to upgrade the building as required by the bye-laws is clearly and properly specified. · Provisions for disproportionate collapse requirements. · · A check of the building permit application plans and specification
DCL 3 Intermediate Check	RC2B	The intermediate check should cover the same criteria as the simple check however a more extensive check of design calculations should be made. Particular attention should be paid to critical or key elements and lightweight cladding assemblies.
DCL 4 Extended Check	RC3	This category of building requires a full design check which should be undertaken by a team who have not been involved in preparing the original design. The checking team should be provided with the drawings and specifications and should undertake analysis and design calculations without reference to the design assumptions or calculations made by the design team.